137-58-6-12852

Effect of Manganese on Sulfur Corrosion of its Alloys With Iron

the authors by stating that Mn gradually accumulating in the interior layer of the scale forms saturated phases of two types (Mn, Fe) S and (Fe, Mn) S, which are characterized by ready permeability relative to the diffusion of atoms of the metal and the metalloid.

P.S.

1. Iron-manganese alloys--Corrosion   2. Sulfur vapors--Corrosive effects
3. Corrosion--Temperature factors

Card 2/2

137-58-6-13166

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 283 (USSR)

AUTHORS: Gol'berg, A.I., Lipatova, V.A., Gel'd, P.V.

TITLE   Electrical Properties of "Lebowite" (Elektricheskiye svoystva leboita)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 252-254

ABSTRACT: An investigation of the relationship of Hall's constant R_x, the resistivity ρ, and the thermoelectromotive force α to the composition of an Fe-Si alloy in the range 47-59% Si at room temperature. Samples were prepared by smelting armco-Fe with technical (99.0%) Si. The melt was drawn into quartz capillaries of 2-4 mm diam. The samples were annealed at 800°C during 10-12 hrs or tempered at 1000° and quenched in water. Hall e.m.f. measurements were carried on by the usual method at a field intensity of 17,000-23,000 oersted. Measurements of α relative to Cu were taken with contact-temperature differences of 100°. The values of R_x and α are sufficiently large and change their sign in the range of 54-55% Si, which indicates semi-conductive properties of the alloys. With Si content $\sim$50% each of the three curves has a sharply

Card 1/2

Electrical Properties of "Lebowite"

defined maximum corresponding to the $FeSi_2$ compound. In general, the results of an examination of tempered samples are consistent with the results obtained for annealed samples; only R_x which corresponds to hole-type conductivity has little relation to composition. R_x and ρ in this case are two orders of magnitude smaller than in annealed samples. The high-temperature modification of "lebowite" is similar to metal in properties.

L.M.

1. Iron-silicon alloys--Electrical properties

Card 2/2

AUTHORS: Gel'd, P.V., Petrushevskiy, M.S.

TITLE: Solubility of Carbon in Ferro-silico-manganese (Rastvorimost' ugleroda v ferrosilikomargantse)

ABSTRACT: The solubility of C at 1460°C in synthetic alloys of the types Fe-Si with up to 40% [Si] and Mn-Si and Fe-Mn-Si with up to 50% [Si]. According to the data, the solubility of C in Fe-Mn alloys increases linearly with the increase in their Mn content. The empirical equations for the calculation of the coefficients of C activity obtained on the basis of data for Fe-Mn-C, Fe-Si-C, and Mn-Si-C alloys, namely,

$$\log_{10} \gamma_C^{Fe, \, Si} = 0.214 N_{Mn}, \quad \log_{10} \gamma_C^{Fe, \, Si} = 215 N_{Si} + 2.25 N_{Si}^2 \quad \text{and} \quad \log_{10} \gamma_C^{Mn, \, Si} = 0.8 N_{Si} + 4.5 N_{Si}^2$$

demonstrates that γ_C is decreased fairly slightly by Mn and increased sharply by Si and that $\gamma_C^{Mn, \, Si} < \gamma_C^{Fe, \, Si}$. This

Card 1/2

Solubility of Carbon in Ferro-silico-manganese

is explained by the fact that Mn strengthens the C bonds considerably (since $\varepsilon_{Mn, C} > \varepsilon_{Fe, C}$, and that Si forms durable groupings with atoms of Fe and Mn. In quaternary alloys Fe-Mn-Si-C, owing to the same cause, γ_C decreases with the substitution of Mn for Fe; with an increase in Si content the solubility of C decreases rapidly. The solubility of C in these alloys increases practically linearly with an increase in Mn content. Therefore, it is recommended that the C content in saturated four-component melts be determined according to the law governing mixing.

V.M.

1. Carbon--Solubility   2. Iron-manganese--silicon alloys--Properties

Card 2/2

SOV/137-58-9-18659

AUTHORS: Yesin, O.A., Kholodov, A.I., Gel'd, P.V., Popel', S.I.

TITLE: Electrochemical Refining and Alloying of Ferrous Metals (Elektrokhimicheskoye rafinirovaniye i legirovaniye chernykh metallov)

PERIODICAL: V sb.: Staleplavil'n. proiz-vo, Moscow, Metallurgizdat, 1958, pp 151-161

ABSTRACT: A description is offered of the results of experiments in 1948-1952 in the electrochemical refining and alloying of metals. The laboratory experiments were run in a resistance furnace with a Silit electrode and in a 50-kg high-frequency furnace. Electrochemical refining of metal proved feasible. The application of an external electrical field to a metal-slag system makes it possible to regulate the speed and completeness of transfer of S from the metal into the slag. Pilot-plant experiments at the Verkh-Isetsk Plant employed a D-C generator (1000 amps, 120 v). The metal was poured into a 300-kg ladle. The results of the industrial experiments showed that when an external electrical field was applied the removal of

Card 1/2

SOV/137-58-9-18659

Electrochemical Refining and Alloying of Ferrous Metals

sulfur from the steel proceeds with considerably greater efficiency than
without electrolysis. Depending upon the initial composition of the metal
and the slag and upon the quantity thereof, the S content diminished by
0.020-0.045% during the first 10 min. Simultaneously with the removal of S
from the metal, an increase in Si content was observed. Current efficiency
was from 20 to 96%. The experiments demonstrated the desirability of
further development of the method and of its introduction into industrial
practice.

L.K.

1. Ores--Processing   2. Metals--Production   3. Iron alloys--Production
4. Metals--Electrochemistry

Card 2/2

GEL'D, P.V.

Role of the gas phase in reducing oxides by carbon. Trudy Inst.
khim. UFAN SSSR no.2:7-44 '58.   (MIRA 12:12)
       (Metallic oxides) (Reduction, Chemical)

YESIN, Yu., O.; GEL'D, P.V.

Reduction of zinc oxide by carbon. Trudy Inst. khim. UFAN SSSR
no.2:63-79 '58.
                                                    (MIRA 12:12)
        (Zinc)   (Carbon)

MATVEYENKO, I.I.; GEL'D, P.V.

Mechanism of the reduction of calcium oxide by aluminum.
Trudy Inst. khim. UFAN SSSR no.2:133-142 '58.

(MIRA 12:12)

(Calcium) (Aluminothermy)

AUTHORS: Gel'd, P. V., **Ryabov**, R. A.   SOV/163-58-3-51/49

TITLE: The Influence Exerted by the Austenite Transformation
              on the Rate of Penetration of Hydrogen in Steel (Vliyaniye
              austenitnogo prevrashcheniya na skorost' proniknoveniya
              vodoroda v stal')

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958,
              Nr 3, pp 189 - 195 (USSR)

ABSTRACT: The rate of the penetration of hydrogen in steel was
              carefully investigated. It is shown that the rate of
              the penetration of hydrogen depends on the change of
              the structure of the steel samples. At temperatures
              of 400 - 800°C an intense decomposition of austenite
              takes place in the steel alloy **34KhM1**; at the same time
              the diffusion rate of hydrogen considerably increases and
              the activation energy drops to E_α = 18 500 cal/mol H_2.

              The influence of the temperature on the rate of pene-
              tration of hydrogen in the steel alloy **34KhNZM** was found
              at 660 - 950°. All structural changes in the steel samples
Card 1/2   were accompanied by the change in the rate of penetration

The Influence Exerted by the Austenite Transformation   SOV/163-58-3-31/49
on the Rate of Penetration of Hydrogen in Steel

and the change of the activation energy of hydrogen.
In dependence on the processing conditions at higher
temperatures different phase diagrams occur which
influence the gas saturation of the steel samples.
There are 4 figures and 8 references, 6 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical
Institute)

SUBMITTED: December 30, 1957

Card 2/2

SOV/78-3-11-2/23

AUTHORS: Alyamovskiy, S. I., Shveykin, G. P., Gel'd, P. V.

TITLE: On Low Niobium Oxides (O nizshikh okislakh niobiya)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1958, Vol 3, Nr 11, pp 2437-2444 (USSR)

ABSTRACT: Experiments were carried out on the possibility of the existence of low niobium oxides. Most pure niobium and oxides produced from it by means of an annealing of the metal at 800-900°C served as initial materials. The following preparations were used: Nb_2O_5, $Nb_2O_{4,9}$ NbO_2, Nb_2O_3, Nb_3O_4, NbO, Nb_2O. The X-ray structure investigations of the phases of the system Nb-O produced by the reduction of Nb_2O_5-Nb-mixtures at a ratio of $Nb : Nb_2O_5 = 3 : 1$ were carried out at 1200°, 1580°, and 1650°C. The results showed that the following phases exist at the temperatures investigated: Nb_2O_5, NbO_2, NbO, and Nb. The phase NbO with the lattice constant a = 4430 X. û. is not produced in the system Nb-O. It was found that a phase with complex rody-centered cubic lattice with the lattice constant

Card 1/2

SCV/78-3-11-2/23

On Low Niobium Oxides

$a = 4201,3$ X.U. exists at the equilibrium between the metal and the oxides. The low oxides Nb_2O, Nb_4O, Nb_3O_7, Nb_3O_5, Nb_2O_3, and Nb_3O_4 do not exist in the case of an interaction between niobium oxide and niobium, and in the presence of carbon. There are 2 figures, 1 table, and 24 references, 5 of which are Soviet.

SUBMITTED: October 24, 1957

Card 2/2

18(0)

AUTHORS: Gel'd, P. V., Krasovskaya, A. Z.   SOV/163-58-4-1/47

TITLE: Effect of the Curvature of Surface on the Reaction Diffusion
(Vliyaniye krivizny poverkhnosti na reaktsionnuyu diffuziyu)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958,
Nr 4, pp 5-11 (USSR)

ABSTRACT: When investigating the process of reaction diffusion it is often
assumed that the factors of diffusion are constant within the
ranges of one-phase strata of reaction products and that the
ratio of the flows of the reagents may be evaluated by the
thickness of the inner and outer lower strata. Such assertions
are not always correct and they may be the cause for wrong
conclusions. The following peculiarities of interaction caused
by the surface curvature of solid reagents may serve as an
illustration. The corrosion process at high temperature was
chosen for an analysis. At first, the kinetic properties
appearing at the oxidation of a metallic specimen of regular
shape, e. g. spherical shape, are investigated. The formulae (2)
and (4) are derived, from which it is to be seen that the
distribution of the concentration M in the stratum of the
reaction product depends substantially upon the curvature of the

Card 1/3

stratum. By comparing the formulae (4) and (5) we can see that, in spherical strata, the sinter is enriched by a metalloid against the corresponding plane sinter. On corroding of specimens having positively curved surfaces, coatings enriched by metalloids form through the whole width. On the contrary, in the case of negatively curved boundary surfaces, a reduction of metalloid contents of the sinter is to be expected, as well as an approximation of its composition to the stoichiometric composition, i. e. a diminution of the concentration of vacancies, and therefore also a reduction of the factors of diffusion of the reagents. It is shown that D_M and D_{Me} do not only depend on temperature, time, and the coordinates of the point but also on the curvature of the sinter.

M – metalloid. Me – metal.

It is further shown that not only D_M and D_{Me} but also the ratio D_{Me}/D_M varies with changing curvature. The truth of this assertion was verified by testing the sulfide corrosion of iron. Besides, a correlation between the surface curvature and the ratio of the volumes of the outer and inner lower strata $(V_1 : V_2)$

Card 2/3

Effect of the Curvature of Surface on the Reaction   SOV/163-58-4-1/47
Diffusion

was ascertained. The mean content of sulfur in the outer lower
stratum of concave sinter was found to be higher by about 1%
than that of plane sinter under equivalent conditions.
S - sulfur. The apparent reasons for the increase of D_S at
growing nonstoichiometric ratios of the sulfide
coating are indicated. Inasmuch as the energy barrier layers,
due to the displacement of the big sulfur atoms, are larger as
compared with the displacement of iron ions, the factors
promoting the loosening of the crystal lattice and the
aggravation of the part performed by the homeopolar bonds are
bound to facilitate the diffusion of sulfur atoms to a higher
extent than iron ions. In this connection, the vacancies that
stand in mutual action with each other are particularly
effective. There are 4 figures and 11 references, 9 of which
are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)
SUBMITTED: March 11, 1958

Card 3/3

32-3-19/52

AUTHORS: Ryabov, R.A., Gel'd, P.V.

TITLE: The Determination of the Diffusion Velocity of Hydrogen in Metals
               (Opredeleniye skorosti diffuzii vodoroda v metallakh)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 3, pp. 306-308 (USSR)

ABSTRACT: The device into which the sample to be investigated is placed has
               a conical opening into which the neck of the sample fits exactly;
               it is filled up with lead so that it is hermetically closed. The
               middle part is heated, whereas the two ends are cooled with water.
               Hydrogen is fed through the vacuum conduction. For the purpose of
               measuring pressure changes (diffusion) a Mak-Leod manometer is
               used. The test sample itself is of a particular cone-like shape;
               the narrow part contains the capillary through which hydrogen
               diffuses. Before being measured the samples are investigated in
               order to find out whether larger pores and/or carbon inclusions
               exist. Diffusion velocity is calculated according to a formula the
               derivation of which is given. By means of the device described the
               number of iron alloys with carbon, chromium, silicon etc., as well
Card 1/2   as constructional steels are investigated. From the results

The Determination of the Diffusion Velocity of   32-3-19/52
Hydrogen in Metals

mentioned it may be seen that the diffusion velocity in alloyed
steels obeys the law of the square root of hydrogen pressure at
low as well as at high temperatures. There are 3 figures, and
8 references, 3 of which are Slavic.

ASSOCIATION: Ural Polytechnic Institute imeni Kirov (Ural'skiy
politekhnicheskiy institut im. Korova)

AVAILABLE: Library of Congress

1. Iron alloys   2. Hydrogen-Diffusion-Velocity

Card 2/2

GEL'D, P.V., prof.; SEREBRENNIKOV, N.N., inzh.; KORSHUNOV, V.A., inzh.

Fusion heat of silicides. Izv. vys. uchob. zav.; chern. met.
no.7:53-62 Jl '58. (MIRA 11:10)

1. Ural'skiy politekhnicheskiy institut.
(Silicides--Thermal properties) (Thermochemistry)

RYABOV, R.A., dots., kand.tekhn.nauk; GEL'D, P.V., prof., doktor tekhn.nauk

Effect of temperature and pressure on hydrogen diffusion in steels
and iron-base binary alloys. Izv.vys.ucheb.zav.; chern.met. no.9:103-113
S '58.
                                              (MIRA 11:11)

1. Ural'skiy politekhnicheskiy institut.
   (Iron alloys--Metallography) (Gases in metals)
      (Metals, Effect of temperature on)

YESIN, Yu.O.; GEL'D, P.V.

Reduction of zinc oxide by carbon. Zhur. prikl. khim. 31 no.7:986-995 Jl '58.   (MIRA 11:9)
(Zinc oxide)   (Carbon)   (Reduction, Chemical)

YESIN, Yu.O.; GEL'D, P.V.

Direct reduction of chromium oxide. Zhur. prikl. khim. 31 no.9:
1285-1293 S '58.   (MIRA 11:10)
            (Chromium oxides) (Reduction, Chemical)

AUTHORS: Semenova, A. K., Gel'd, P. V.   76-32-5-27/47

TITLE: The Effect of Chromium on the Sulfide Corrosion of Its Iron
                Alloys (Vliyaniye khroma na sul'fidnuyu korroziyu yego splav-
                ov s zhelez om)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol. 32, Nr 5, pp. 1087-
                -1094 (USSR)

ABSTRACT: The influence of chromium on the oxidation kinetics of its
                iron alloys in sulfur vapors as well as the structural proper-
                ties of the tinder formed on this occasion were investigated.
                From the experimental part can be seen that alloys with from
                0 to 19.2% chromium were investigated which were melted in
                Shteynberg-Gramolin furnaces under the assistance by A. I.
                Pastukhov. The tests were carried out in a specially construct-
                ed vessel while the thermo e.m.f. was measured according
                to the method by G. D. Fedorov. The determinations of the ve-
                locity of corrosion took place at 500, 600, 700 and 800°C
                with different heating times. It was observed that the cor-
                rosion velocity decreases with the temperature drop and the
                increase of the chromium content, with also a decrease of the
                tinder layer having been observed. A stronger effect of chro-
Card 1/3   mium was noticed only to a content of 4-12%, so that, for in-

The Effect of Chromium on the Sulfide Corrosion of Its Iron   76-32-5-22/47
Alloys

stance, with additions of 12-17% chromium the corrosion re-
sistance increases to the 1o-2o-fold. The x-ray structural
and chemical investigations showed that the tinder consists
of two different layers the thickness of which changes with
the chromium content, with the chromium accumulating in the
inner layer and with spinels having been found present. In
determinations of the thermo e.m.f. it was observed that the
inner layer has a greater activation energy which points at
an energetic complicatedness in the charge transfer by the
impinging of chromium ions. In evaluating the results the
analogy of the oxidation with oxygen and sulfur is stressed,
reasoned in detail and explained, and among others it is
mentioned that the principle of heat resistance according
to V. I. Arkharov (Ref 15) can also be extended to the sul-
fide corrosion, and that the corrosion resistance of the form-
ation velocity of the spinel protective layer is dependent
on a normal lattice parameter.There are 4 figures, 2 tables,
and 15 references, 11 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S. M. Kirova,Sverdlovsk
Card 2/3

AUTHORS: Gel'd, P. V., Petrushevskiy, M. S.   SOV/ 2o-12o-1-39/63

TITLE: The Solubility of Carbon in Ferrosilicomanganese (Rastvorimost'
             ugleroda v ferrosilikomargantse)

ABSTRACT: Systematic details on the solubility of C in alloys Mn-Si-C
             and Mn-Si-Fe-C (References 1-3) are not available in technical
             publications. The authors therefore investigated the solubility
             of C in synthetic alloys Fe-Mn-Si at 146o$^{\circ}$. As seen from the
             graphs (Figures 1-4) the replacement of iron by manganese (si-
             milar to the system Mn-Fe-C) leads to a linear increase of car-
             bon solubility. Determination of the carbon content in saturated
             4-component melting can be carried out according to the rule of
             mixtures:

$$[C]_{Mn,Fe,Si} = \frac{[Fe]\ [C]_{Fe,Si}}{[Fe]+[Mn]} + \frac{[Mn]\ [C]_{Mn,\ Si}}{[Fe]+[Mn]}$$

             where $[C]_{Mn,Fe,Si}$, $[C]_{Fe,Si}$, $[C]_{Mn,Si}$ are the solubility figures

Card 1/2   of carbon in the alloys concerned, which are distinguished by

The Solubility of Carbon in Ferrosilicomanganese   SOV2o-12o-1-39/63

the silicon concentration prescribed. The results of the examination of the 4-fold alloys are described in figure 4. The graph was constructed on the assumption that $[Fe] + [Mn] + [Si] = 100\%$. From this as well as from figure 2 it may be seen that carbon solubility decreases rapidly when the silicon content is increased. Apparently the concentration rise of manganese causes under the existing conditions a tighter linkage of the carbon atoms with the metal which means that the activity coefficient is reduced the more the manganese content in the alloy increases. There are 4 figures and 4 references, 2 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S. M. Kirova (Ural Polytechnic Institute imeni S. M. Kirov)

PRESENTED: September 6, 1957, by S. I. Vol'fkovich, Member, Academy of Sciences, USSR

SUBMITTED: September 6, 1957
            1. Carbon--Solubility   2. Iron-manganese-silicon alloys--
Card 2/2   Solvent action

Gel'D, P.V.

PHASE I BOOK EXPLOITATION   SOV/3459

Termicheskaya obrabotka i svoystva krupnykh pokovok (Heat Treatment and Properties of Large Forgings), Moscow, Mashgiz, 1959. 165 p. 4,000 copies printed.

Reviewer: K.N. Sokolov, Candidate of Technical Sciences; Ed.: P.V. Sklyuyev, Candidate of Technical Sciences; Tech. Ed.: E.A.Dugina; Exec. Ed.(Ural-Siberian Division, Mashgiz): A.V. Kurilina, Engineer.

PURPOSE: This book is intended for technical personnel working in the shops, laboratories, and design offices of plants manufacturing heavy machinery and electrical equipment. It may also be of some interest to research personnel.

COVERAGE: This collection of articles describes methods employed by Uralmashzavod (Ural Heavy Machinery Plant, Sverdlovsk) for heat-treating heavy forgings. A method recommended at the plant for normalizing of heavy forgings are given. A considerable portion of the book is devoted to information on the mechanical rates in the quenching and normalizing of heavy forgings are given. A considerable portion of the book is devoted to information on the mechanical properties of rotors for heavy turbogenerators and oversized steam-turbine rotors at various points along the body and out of the rotor. The salt defects occurring in rotors of these type are explained, their causes are analyzed, and methods of locating the production of vacuum-treated steel are given. No particular study of heavy forgings made of vacuum-treated steel are given. No particular cases are mentioned. References accompany most of the articles.

GEL'D, P. V.

> with Gertman, Yu. M.,   "The thermochemistry of the solid and liquid silicides of Mn."

> with KUSENKO, F. G.   "The thermochemistry of the Oxides and carbides of Nb."

> with Matveyenko, I. I. and Alyamovskiy, S. I., "Kinetika vosstanovleniya pyatiokisi
>   vanadiya vodorodom."

> with Matveyenko, I. I. and Alyamovskiy, S. I., "Utochneniye oblasti $\emptyset$primenimosti
>   printsipa posledovatelynosti prevrashenly akad. A. A. Baykova."

> with Serebrennikov, N. N. and Krentsis, R. P.,   "Ustanovka dlya isslekovaniya
>   teplosoderzhaniya tverdykh i zhidkikh splavov.

reports submitted for the 5th Physical Chemical Conference on Steel Production,
Moscow, 30 June 1959.

29(8)

PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotemper-
turnykh issledovaniy, 1956

Experimental'naya tekhnika i metody issledovaniy pri vysokikh tem-
peraturakh; trudy soveshchaniya (Experimental Techniques and
Methods of Investigation at High Temperatures; Transactions of the
Conference on Experimental Techniques and Methods of Investigation
at High Temperatures) Moscow, AN SSSR, 1959. 769 p. (Series:
Akademiya nauk SSSR. Institut metallurgii. Komissiya po fiziko-
khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

Resp. Ed.: A.M. Samarin, Corresponding Member, USSR Academy of
Sciences; Ed. of Publishing House: A.L. Sakvitser.

PURPOSE: This book is intended for metallurgists and metallurgical
engineers.

COVERAGE: This collection of scientific papers is divided into six
parts: 1) thermodynamic activity and kinetics of high-temperature
processes 2) constitution diagram studies 3) physical properties
of liquid metals and slags 4) new analytical methods and pro-
duction of pure metals 5) pyrometry and 6) general questions.
For more specific coverage, see Table of Contents.

TABLE OF CONTENTS:

I. DETERMINATION OF THERMODYNAMIC ACTIVITY AND
METHODS OF INVESTIGATING THE KINETICS OF HIGH-
TEMPERATURE PROCESSES

Golik, F.V. Methods of Investigating the Kinetics and
Equilibria Characteristics of Certain Heterogeneous Reactions
The kinetics are investigated by: 1) studying the change
in weight of condensed reagents with time 2) studying the
change in pressure and volume of gas, and 3) other methods
(thermographic, dilatometric, electrical, and magnetic).
Equilibria are investigated by: 1) static methods (mano-
metric methods, circulation methods, and construction of
condensed phases, and construction methods, study of saturation of
condensed phases, and construction methods) and 2) dynamic
methods (jet method, control of pressure, thermal methods,
and study of vaporization rate).

Card 2/32

Ryabov, R.A., and P.V. Gel'd. Rate of Hydrogen Diffusion in
Steels at High Temperatures
The rate of diffusion at a given temperature was determined
on the basis of the quantity of hydrogen diffusing per unit
time through a unit section of fixed thickness, as measured
by the drop in pressure. The effect of alloying elements
(carbon, chromium, vanadium, silicon, manganese, and nick-
el), composition of austenite, and pressure on the rate
of diffusion were studied.

Petrov, Ya.P., and L.A. Shvartsman. Effect of Alloying
Elements on the Thermodynamic Activity of Carbon in Gamma Iron
A method was developed for determining the thermodynamic
activity of carbon in solid solutions. Data were obtained
on the effect of additions of manganese, chrome, vanadium,
and titanium on the activity of carbon in gamma iron. All
these elements markedly decrease the activity of carbon in
comparison with nonalloyed austenite. This indicates that
the bond strength of carbon dissolved in gamma iron is
considerably increased upon introduction of carbide-forming
elements into a solid solution. The strongest effect on
the activity of carbon, determined by the position of the
investigated elements in the periodic table, was produced by
titanium, and the weakest by manganese. The quantitative
difference in the effect of titanium, vanadium, and chrome
is small and approaches the accuracy of the measurements.

SOV/180-59-1-8/29

AUTHORS: Gel'd, P.V. and Shveykin, G.P. (Sverdlovsk)

TITLE: Some Peculiarities of the Carbon-Thermic Reduction of
              Niobium Pentoxide (Nekotoryye osobennosti ugletermiches-
              kogo vosstanovleniya pyatiokisi niobiya)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnicheskikh
              nauk, Metallurgiya i toplivo, 1959, Nr 1, pp 44-49 (USSR)

ABSTRACT: It has been shown (Refs 1,2) that the direct production of
              niobium by reaction of the pentoxide with carbon is not
              suitable technically. A better method, probably, is to
              cause the pentoxide to react with carbon to give the
              carbide which is then heated with a further portion of
              pentoxide to give the metal. To provide technically
              useful information on the latter reactions the authors
              have studied the reaction kinetics. The Nb_2O_5, of 97.4 -
              99.8% purity, was prepared in various ways (Table 1),
              the monoxide and dioxides were prepared by vacuum fusion
              of pentoxide-carbide mixture. The carbon was in the form
              of acetylene black, graphite, coaltar pitch and its
              coking products. The reagents were mixed, finely ground,
              pressed into briquettes and heated in vacuum with
Card 1/3   continuous weighing. Considerable differences were

SOV/182.59-1-8/29

Some Peculiarities of the Carbon-Thermic Reduction of Niobium
Pentoxide

found in the percent reduction vs. time (min) curves
(Fig 1) for the various preparations of Nb_2O_5, previous .
heat treatment being an important factor since it alters
the phase composition (as confirmed by an X-ray struc-
tural investigation carried out by S.I. Alyamovskiy).
The T-phase, stable below 900°C, was found to be the most
reactive as shown by the percent reduction vs. time (min)
curves in Fig 2, of which curves 11 and 12 correspond to
niobium-hydroxide calcining temperatures of 550 and 530°C
respectively, 13 and 14 to 800°C, 15 and 16 to 900°C,
17, 18 and 19 to 1000°C and 20 to 1200°C. The curves
show that the attainment of the NbO_2 stage does not
correspond to slower reaction, and the authors attribute
this to the disruption of grains in the first stage. The
reduction proceeded rapidly at a pressure of 10^{-1}mm Hg,
and even at 3-4 mm Hg. The presence of small amounts of
potassium salts greatly accelerated the reduction, as did
the use of a more finely divided reducing agent (Fig 4).
Examinations were carried out on partially-reduced
products: only Nb_2O_5, NbO_2 and NbC_x (x = 0.86 - 0.89)

Card 2/3 were found after reduction at 1050-1250°C, similar

SOV/180-59-1-8/29

Some Peculiarities of the Carbon-Thermic Reduction of Niobium
Pentoxide

conclusions being reached from other experiments. The
authors recommend the technical adoption of a process in
which the first stage is the production of a dioxide-
carbide mixture from the low-temperature modification of
Nb_2O_5 rather than the intermediate-carbide process. The
reaction of a synthetic carbide (11.4% C) with oxide
was found to be very slow below $1250^{\circ}C$; on raising the
temperature to 1350, 1500 and $1600^{\circ}C$ successive stages of
reduction are reached (Fig 5). Further tests showed that
at $1750-1800^{\circ}C$ and a pressure of 5×10^{-3} mm Hg, 98.8 –
99.8-% Nb sponge could be obtained by direct reduction of
Nb_2O_5 with coaltar pitch, from an oxide-carbide mixture
or by reduction of Nb_2O_5 with the highest carbide of
niobium. The advantages of the second method were con-
firmed in larger-scale (up to 3 kg of niobium) experiments.
Card 3/3   There are 5 figures, 3 tables and 11 references, 9 of
which are Soviet, 1 English and 1 German.
SUBMITTED: June 30, 1958

AUTHORS: Petrushevskiy, M.S. and Gel'd, P.V.   SOV/80-59-1-14/44

TITLE: Equilibrium of Carbon With Liquid Alloys of Fe, Mn, Si, C
            (Ravnovesiye ugleroda s zhidkimi splavami Fe, Mn, Si, C)

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Nr 1, pp 86-95 (USSR)

ABSTRACT: The purpose of the present investigation was to determine the
            solubility of carbon in manganese and its alloys with iron
            and silicon at a temperature of 1,460°C. As materials for
            experimenting were used armco-iron, electrolytic manganese
            and commercial silicon ($\sim$98.5% Si). The following systems
            were investigated: Fe - Si - C; Mn - Si - C; Fe - Mn - C,
            and Fe - Mn - Si - C. The results obtained led to the con-
            clusions: 1. It was established for the binary alloys Fe,
            Si and Mn, Si that at 1,460°C the coefficient of carbon ac-
            tivity increases with the rise of silicon concentration, and
            the rate of increase is higher in the former system. In the
            alloys of Mn, Fe an increase in manganese concentration leads
            to an insignificant lowering of this coefficient, f_C · 2.
            The study of carbon solubility in alloys Fe, Mn, Si has shown
            that also in this case the carbon activity coefficient rises
            with the increase in silicon concentration. The substitution
            of Fe with Mn leads practically to the linear decrease of this
            coefficient. 3. These relationships are explained by that
Card 1/2   the binding energy of silicon with iron is higher than that

SOV/80-50-1-14/44

Equilibrium of Carbon With Liquid Alloys of Fe, Mn, Si, C

with manganese, while for carbon the reverse is the case. It
turned out that the quantitative relations derived can be
approximately described by the equations following from the
theory of strictly regular solutions.
There are 8 graphs and 15 references, of which are Soviet,
6 American, 1 German and 1 Japanese.

SUBMITTED: May 21, 1957

Card 2/2

SOV/148-59-2-10/24

18(3)

AUTHORS: Ryabov, R.A., Candidate of Technical Sciences, and Gel'd, P.V., Professor, Doctor of Technical Sciences

TITLE: The Effect of Alloying Elements on Hydrogen Permeability of Steels and Iron-Basis Binary Alloys (Vliyaniye legiruyushchikh elementov na vodorodopronitsayemost' staley i binarnykh splavov na osnove zheleza)

ABSTRACT: In order to complete existing data experiments were carried out for the purpose of determining the effect of carbon, chromium, silicon, manganese, and nickel on hydrogen permeability of steels and iron-basis binary alloys. Data obtained were compared with results of investigations carried out by A.A. Shcherbakova, P.L. Gruzin, V.K. Kritskaya, G.V. Kurdyumov, T.I. Stelletskaya, and V.A. Il'ina. The experiments proved that the majority of admixtures (such as C, Si, Cr, Mn and possibly Al), considerably reduced the hydrogen diffusion rate. On the one hand the admixtures

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SOV/148-.9-'-10/24

The Effect of Alloying Elements on Hydrogen Permeability of Steels and Iron-Basis Binary Alloys

caused changes of interparticle interactions in the ferrite lattice and the local distortions of the energy spectrum of electrons; on the other hand distortion of the crystalline lattice, changes of inter-atomic spaces and of interstitial space dimensions took place. Carbon had a retarding effect on hydrogen diffusion, reducing the solubility and transiti possibilities of hydrogen. Chromium strengthened inter-particle bonds. Silicon caused considerable static distortion of the lattice and of the energy spectrum of electrons. Increased hydrogen permeability, observed in steel with Nb and Ti admixtures, was caused by decarbonization and not by the effect of the admixtures on the ferrite lattice. The alloying element had a negative effect on hydrogen perme-ability if, after having bound the carbon, it formed part of

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SOV/148-59-2-10/24

The Effect of Alloying Elements on Hydrogen Permeability of Steels and
Iron-Basis Binary Alloys

the solid solution. It was confirmed that in the investi-
gated process the part of inter-granular hydrogen migration
was unimportant and that diffusion characteristics were main-
ly determined by the transcrystalline hydrogen flow. The
author presents graphs showing the dependence of hydrogen
permeability on different admixtures.
There are 9 graphs and 27 references, 21 of which are Soviet,
4 German and 2 English

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical
Institute), Kafedra fiziki (Chair of Physics)

SUBMITTED: June 25, 1958

Card 3/3

MATVEYENKO, I.I., inzh.; GEL'D, P.V., prof.; ALYAMOVSKIY, S.I., inzh.

Reduction kinetics of vanadium pentoxide by hydrogen.
Izv. vys. ucheb. zav.; chern. met. 2 no.4:13-21 Ap '59.
(MIRA 12:8)

1.Ural'skiy politekhnicheskiy institut i Ural'skiy filial Akademii
nauk SSSR.
          (Vanadium—Metallurgy) (Oxidation-reduction reaction)

GERTMAN, Yu.M., inzh.; GEL'D, P.V., doktor tekhn.nauk prof.

Thermochemistry of silicomanganese. Izv.vys.ucheb.zav.; chern.
met. 2 no.9:15-27 S '59.   (MIRA 13:4)

1. Ural'skiy politekhnicheskiy institut. Rekomendovano kafedroy
fiziki Ural'skogo politekhnicheskogo instituta.
          (Thermochemisty) (Silicon alloys) (Manganese alloys)

18(6)   SOV/78-4-5-27/46
AUTHORS: Kocherov, P. V.,   Gertman, Yu. M.,   Gol'd, P. V.

TITLE: The Formation Heat of the Alloys of Calcium With Aluminum
            (Teploty obrazovaniya splavov kal'tsiya s alyuminiyem)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 5,
            pp 1106-1112 (USSR)

ABSTRACT: The formation heat of the pure intermetallic compounds of
            calcium with aluminum ($CaAl_2$ and $CaAl_4$) was calculated.

            The alloy was produced from the purest electrolytic twice
            distilled calcium and electrolytic aluminum. Melting of the
            components took place in the purest argon atmosphere. By
            means of radiostructural and metallographical investigations
            the composition of the alloy was determined and the results
            are shown by table 1. Determination of the formation heat
            of the alloys was carried out by means of an ordinary iso-
            thermal calorimeter, viz. by the differential method as
            follows: First the combustion heat of the alloy, and then

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SOV/78-4-5-27/46

The Formation Heat of the Alloys of Calcium With Aluminum

the equivalent combustion heat after composition of the mechanical mixtures of calcium and aluminum was investigated. From the difference between the average values the formation heat of the respective alloy was calculated. The accuracy of the method is $1.0 - 1.5$ kcal/g-at. The combustion method, the oxidation heat of the purest metals, as well as the six alloys and their corresponding mechanical mixtures were investigated. The results obtained by calorimetric determinations carried out by the combustion method are shown by table 2. The combustion heat of the alloys and the mechanical mixtures of calcium and aluminum are shown by figure 3. For $\Delta H_{Al_2O_3}$

- 399 kcal/g-mol Al_2O_3 was found. This value agrees well with data found in publications; $\Delta H_{Al_2O_3} = -400 \pm 2.0$ kcal/g-mol

Al_2O_3. The dissolution heat of calcium and aluminum and of their alloys in 5 n hydrochloric acid was investigated. The

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The Formation Heat of the Alloys of Calcium With Aluminum

results obtained are shown by table 3 and figure 4. Figure 5 is a graphical representation of the formation heats of calcium- and aluminum alloys of various composition according to the combustion- and dissolution method. The experimentally obtained values agree well with those found in publications. The following values were found for the formation

heat of the intermetallic compounds $CaAl_2$ and $CaAl_4$:

$$\Delta H_{CaAl_2}^{22.5^0} = -17.5 \pm 1.5 \text{ kcal/g-at and}$$

$$\Delta H_{CaAl_4}^{22.5^0} = -10.3 \pm 1.0 \text{ kcal/g-at.}$$

There are 5 figures, 3 tables, and 13 references, 2 of which are Soviet.

Card 3/4

18(3), 24(6)   SOV/170-59-6-13/20

AUTHORS: Gel'd, P.V., Ryabov, R.A.

TITLE: Effect of Carbon on Hydrogen Diffusion in Steel

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 6, pp 88-90 (USSR)

ABSTRACT: Experimental data obtained previously by the authors [Refs 1, 2]
             indicate that the constant of permeability and the coefficient of
             diffusion of hydrogen in carbon steels decrease rapidly with an
             increase in carbon content. In the present paper the authors
             compare these experimental data with an equation of generalized
             permeability derived by Odelevskiy [Ref 3]. However, the use of
             his equation, Formula 4 in the text, necessitates the knowledge of
             permeability of cementite as well as that of ferrite. As the
             characteristics of cementite are not yet available, only relative
             permeabilities of steels were compared instead of absolute ones.
             The results are presented in Figure 1 in which the values of
             relative permeability Ψ were plotted versus the volume concentra-
             tions of ferrite. The results of measurements agree with
Card 1/2   Odelevskiy's formula under assumption that the permeability of

Effect of Carbon on Hydrogen Diffusion in Steel   SOV/170-59-6-13/20

cementite amounts to 4 or 5% of that for ferrite. The relation-
ship found is characteristical only for the hydrogen permeability
through steels of a definite structure, namely those containing
lamellar perlite.
There are: 1 graph and 3 Soviet references.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S.M. Kirova (Ural Poly-
technical Institute imeni S.M. Kirov), Sverdlovsk.

Card 2/2

24(3), 24(2), 18(3)   SOV/126-7-2-37/39

AUTHORS: Gol'dberg, A. I., Lipatova, V. A. and Gel'd, P. V.

TITLE: The Effect of Decomposition of Leboite on Electrical
           Properties of Iron-Silicon Alloys (Vliyaniye raspada
           leboita na elektricheskiye svoystva splavov zheleza s
           kremniyem)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 2,
           pp 316-317 (USSR)

ABSTRACT: Leboite and disilicides of chromium and manganese
           exhibit semiconducting properties (Refs 1-6). These
           properties, in conjunction with their low thermal
           conductivity (Refs 3,7), give a special interest to
           these materials. For this reason the authors studied
           the effect of composition on the thermoelectric power,
           the Hall constant and electrical conductivity of FeSi-Si
           alloys. Measurements were carried out at room temperature
           on cast cylindrical samples. To obtain the high-
           temperature modification (α-leboite) the samples were
           annealed for four hours at 1000°C and then quenched in
           water. To stabilize β-leboite, raw samples were
           annealed for 10-12 hours at 800°C and then cooled
Card 1/4 gradually to room temperature. The Hall e.m.f. was

SOV/126-7-2-37'39

The Effect of Decomposition of Leboite on Electrical Properties
of Iron-Silicon Alloys

measured at applied magnetic fields from 17000-23000
oersted.   The electrical resistance and thermoelectric
power were measured simultaneously with the Hall effect
by a method described earlier (Ref 1). It was found
that electrical properties of iron-silicon alloys are
very sensitive to the phase state of leboite. This is
due to the fact that the high-temperature α-phase has
an electrical resistivity, Hall constant and thermo-
electric power, about three orders lower than those of
the low-temperature modification (β-leboite). Thermo-
electric power α depends strongly on the alloy
composition. It is comparatively small at low contents
of leboite but rises strongly on approach to the
stoichiometric composition of β-leboite and then falls
rapidly, changing its sign above 55 wt.% of Si. At its
maximum the value of α reaches 0.035 mV/$^\circ$C. Other
properties of these alloys also depend strongly on
composition. In particular (Fig 1) the 20°C isotherms of
Card 2/4 electrical resistivity (ρ) and the Hall constant (R_x),

The Effect of Decomposition of Leboite on Electrical Properties
of Iron-Silicon Alloys

are similar to the thermoelectric power isotherm.
The maxima of α, ρ and R_x occur at practically the
same composition. The high values of α, ρ (max. of
2.0 Ohm.cm) and R_x (max. of 20 c.g.s, units) confirm
that β-leboite is a semiconductor. In alloys containing
up to 55 wt.% of Si, the hole mechanism of conductivity
predominates; the hole density is of the order of
$(3-5) \times 10^{18}$ cm^{-3} and their mobility is of the order of
1 cm^2 sec^{-1} V^{-1}. Alloys with more than 55 wt.% of Si
have predominantly electron conductivity. Electrical
properties of alloys containing α-leboite are quite
different. Up to the point when Si separates out
(55 wt.% of Si) alloys with α-leboite exhibit low thermo-
electric power, electrical resistivity and Hall constant
(Fig 2). This indicates that the semiconducting
properties are lost on transition from β-leboite to
α-leboite. A certain scatter of values of electrical
conductivity of quenched samples (with α-leboite) is
due to microcracks which are produced by large volume
Card 3/4   changes on transition to α-leboite.

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The Effect of Decomposition of Leboite on Electrical Properties
of Iron-Silicon Alloys

There are 2 figures and 9 Soviet references.

(Note: This is an abridged translation)

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni S.M.Kirova
(Ural Polytechnical Institute imeni S. M. Kirov)

SUBMITTED: February 19, 1958

Card 4/4

67727

AUTHORS: Igishev, V. N. and Gel'd, P. V.   SOV/126-7-3-34/44

TITLE: Temperature Dependence of the Electrical Conductivity of Leboite (Temperaturnaya zavisimost' elektroprovodnosti leboita)

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 3, pp 463-465 (USSR)

ABSTRACT: Earlier studies of the properties of leboite (Ref 1) showed that it can exist in two modifications: a low-temperature β-form and a high-temperature α-form. The β-form, stable below 950°C, is a semiconductor. The α-form exhibits metallic conduction. All these data were obtained at room temperature. The present paper reports an extension of earlier work to a wider range of temperatures; the authors measured the electrical conductivity of leboite between 20 and 1000°C. Leboite was prepared from silicon with less than 0.03 of impurities and from electrolytic iron. For the sake of comparison one sample was prepared from technical materials: silicon of Kr-0 grade and transformer steel. Samples of 50 mm length and 3 mm diameter were prepared by sucking-in molten leboite

Card 1/3   into quartz tubes. Some of the samples were annealed at

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Temperature Dependence of the Electrical Conductivity of leboite

800°C for 20 hours in order to stabilize β-leboite. Other samples were subjected to homogenizing annealing at 1100°C and subsequent quenching; this was done in order to fix the α-leboite structure. The electrical conductivity was measured by the usual compensation circuit. During measurement samples were heated in an atmosphere of purified nitrogen. The results are shown on a semi-logarithmic scale in Fig 1, where log σ is plotted against $10^3/T$. The even-numbered curves give the temperature dependence of the conductivity of stabilized samples and the odd-numbered curves give the characteristics of quenched samples. The even-numbered curves show that the electrical conductivity of β-leboite rises rapidly with temperature. The comparatively low electrical conductivity and the positive temperature coefficient confirm the semiconducting nature of β-leboite. The forbidden band width of β-leboite is 0.2 eV at room

Card 2/3   temperature and is not very sensitive to the silicon

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Temperature Dependence of the Electrical Conductivity of Leboite

content (curves 2, 4, 6) and the amount of impurities present (curve 8). Near the limit of stability of β-leboite the forbidden band width reaches 1.0-1.3 eV. The odd-numbered curves confirm the metallic nature of the conduction of α-leboite; its resistivity is comparatively small both in the case of samples prepared from pure materials (curves 1, 3, 5) and in the case of samples made from technical materials (curve 7). Quenched α-leboite was stable up to about 600-650°C. At higher temperatures it decomposed into β-leboite and silicon and its resistivity increased. The rate of transformation from α into β-form rose rapidly near 750-800°C which agreed well with earlier (dilatometric) results (Ref 4).
There are 1 figure and 4 Soviet references.

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni S.M.Kirova (Ural Polytechnical Institute imeni S. M. Kirov)

SUBMITTED: June 7, 1958

Card 3/3

SOV/126-7-4-18/26

AUTHORS: Krasovskaya, A.K. and Gel'd, P.V.

TITLE: Distribution of Chromium in Sulphide Scale on Iron-
             Chromium Alloys

ABSTRACT: By means of X-ray and metallographic analysis, the
             authors studied the scale formed on iron-chromium alloys
             containing from 1 to 29% Cr held for 2 to 6 hours at
             800°C in the presence of sulphur vapour. They found that
             scale formed under these conditions consisted of two
             layers: a surface layer and an under-layer with chromium
             in the form of $FeCr_2S_4$ (spinel), concentrated mainly in
             the outer part of the under-layer. In alloys containing
             less than 4% Cr, the $FeCr_2S_4$ grains were so small that
             they were not resolved at 600 magnification. They
             became larger (0.03 to 0.05 mm) in alloys containing
             4 to 12% Cr, while in alloys with the chromium content
             higher than 12%. a continuous layer of $FeCr_2S_4$ was formed,
             separating the outer and the inner layers of the scale.
             A micro-photograph of scale formed on an alloy containing
Card 1/4   17% Cr is reproduced in Fig 1, showing: A – the outer

Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

layer; B - the continuous layer of $FeCr_2S_4$;
V - the under-layer. The temperature dependence of
electrical conductivity, σ, of this ($FeCr_2S_4$) part of
the scale and of pyrrhotine (FeS) was determined, and
it was found that: (1) the activation energy of the
process in spinel is higher than that in FeS (0.2eV
against 0.04eV); (2) the conductivity of spinel is low:
at $-186°C/\sigma_{spinel}:\sigma_{pyrrhotine} \approx 10 - 30$. Thus, it was
shown that the resistance of high chromium content steels
to the action of sulphur at high temperatures is due to
the formation of a protective layer of $FeCr_2S_4$.
Regarding the fact that this compound is formed not in
the immediate vicinity of the metal but at the interface
of the two scale layers, the authors offer an explanation
based on the possibility of the formation of divalent
and trivalent chromium cations. The inner layer of the
scale is formed by the interaction between the sulphur
atoms diffusing through the sulphide layer and the atoms
of both iron and chromium. Under the conditions of
intimate contact with the metal which acts as a reducing
agent ($Me + M^{3+} \rightarrow 2Me^{2+}$), sulphide, containing mainly

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Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

divalent cations, is formed. Since in this region of
the system the iron content is higher than the chromium
content, and the number of lattice defects in pyrrhotine
is small, the concentration of trivalent chromium cations
due to reaction $Fe^{2+} + Cr^{3+} \rightleftharpoons Fe^{3+} + Cr^{2+}$ will be quite
small. For this reason, and also due to isomorphism and
similarity of the parameters of CrS and FeS (which form
a continuous series of solid solutions), pyrrhotine
alloyed with chromium is formed in this part of the scale.
Diffusion of the Fe and Cr cations to the outer layer of
the scale results (due to higher mobility of Fe^{2+} cations)
in an increase of the concentration of the Cr cations in
the inner layer of the scale. Owing to this and to the
growing number of defects in pyrrhotine, as the diffusing
Cr cations approach the outer part of the under-layer,
they change their charge and become trivalent. With
increasing concentration of the trivalent Cr cations in
the sulphide lattice, favourable conditions are created
for the formation of spinel. The authors conclude by
drawing attention to the fact that at higher temperatures
Card 3/4   (at which the activation energy of the diffusion and

SOV/126-7-4-18/26

Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

electrical conduction processes in spinel is comparatively high) the protective power of chromium diminishes. Thus, the ratio of constants characterising the rates of oxidisation of alloys with 1.09 and 17.46% Cr at 500°C is equal to 570 and at 800°C only 55, which means that with rising temperature the permeability of the sulphide spinel increases more rapidly than that of pyrrhotine. There is 1 figure and 4 references, 3 of which are Soviet and 1 German.

ASSOCIATION:Ural'skiy politekhnicheskiy institut imeni S.M.Kirova (Ural Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: May 16, 1958

Card 4/4

SOV/126-—-7-5-16/25

AUTHORS: Ryabov, R. A.   and Gel'd, P. V.

TITLE: Relationship Between the Structural and Diffusion Prop-
          erties of Steels (Svyaz' strukturnykh i diffuzionnykh
          kharakteristik staley)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 5, pp 732-741
          (USSR)

ABSTRACT: The authors undertook a detailed study of the dependence of
          the rate of hydrogen penetration through steel on the conditions
          under which the second transformation step is brought about.
          The rate of hydrogen penetration J was determined by
          measuring the quantity of hydrogen M passing through a
          flat steel membrane of thickness e and cross-sectional area
          s in time τ by the formula $J = M/\tau s$ (Ryabov, Ref.5);
          hence the penetration constant

$$P = Je/\sqrt{p_1}$$

          where p_1 is the hydrogen pressure on entering the membrane.
          An apparatus was used consisting of a hydrogen generator,

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1/3

SOV/126---7-5-16/25

Relationship Between the Structural and Diffusion Properties
of Steels

       a diffusion block with the specimen and a vacuum block for
de-gassing the apparatus at the beginning of the experiment
as well as for measuring the quantity of hydrogen diffused
(Fig.2).   The results of the study of steel 3KhN3M   which
tends to develop the second transformation step are shown
in Fig.3.   In Fig.4 the influence of temperature on the
penetration of hydrogen through the steel 3KhN2M   is shown.
Measurements were carried out during cooling.   In Fig.5 the
dependence of hydrogen penetration through steel 9Kh2V   on
temperature is shown.   Measurements were taken during cooling.
Fig.6 shows the influence of the temperature from which steel
34KhN2M is cooled on hydrogen penetration.   Measurements were
carried out during cooling.   Fig.7 shows the influence of
temperature and thermal history of the specimen on the
penetration of hydrogen through steel 20Kh2N4A.   Measurements
were carried out during cooling.   Fig.8 shows isobars of
hydrogen penetration through the steel 40KhNMA.   The authors
arrive at the following conclusions:

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2/3

1.   In temperature ranges in which an intense decomposition of
austenite takes place the constant of hydrogen penetration in
steel sharply increases with simultaneous decrease in the

SOV/126---7-5-16/25
Relationship Between the Structural and Diffusion Properties of Steels

activation energy of the process.

2.   In different steels the completeness of austenite de-
composition in the first step and hence the extent of
decomposition in the second step are different and can be
determined by the chemical composition of the steel as well
as by its cooling rate.   These relationships are fully
reflected in the curves representing the temperature dependence
of the constant of hydrogen penetration through steel.   This
enables the use of this method for the study of structural
transformations in steels on the one hand, and on tne other
(and this is in practice more important) it enables the
influence of various types of thermo-mechanical treatment of
steels on their gas saturation to be estimatea.
There are 8 figures and 14 references, of which 11 are Soviet,
2 English and 1 German

Card
3/3

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni S. M. Kirova
(Urals Polytechnic Institute imeni S. M. Kirov)
SUBMITTED: May 17, 1957

18. 1150

66239

SOV/126-8-3-26/33

AUTHORS: Sidorenko, F.A., Gel'd, P.V. and Dubrovskaya, L.B.

TITLE: On the Type of Defects in α-Leboite

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 465-466 (USSR)

ABSTRACT: In view of the fact that the lattice parameters decrease with increase in silicon content in the ζ_α-phase (α-leboite) of the Fe-Si system, the assumption was made by Phragmen (Ref 1) that iron bi-silicide-base substitutional solid solutions are formed. A precise determination of the densities of leboite alloys and their lattice parameters have, however, led to results which contradict this assumption. An investigation has been carried out with alloys prepared in a tungsten vacuum furnace from pure (99.95% Si) silicon and P-4 carbonyl iron. The alloys were homogenized in vacuum at 1080 C for 100 hours. The densities of powders, crushed in an agate mortar, were measured by a pycnometric method in an evacuated pycnometer. The lattice parameters were determined with a БPC-3 camera. Their dimensions for alloys of different compositions (see Table) show that the phase under investigation is stable in the concentration

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On the Type of Defects in   α-Leboite

range 53.5 to 56.5% Si, which agrees with Haughton and
Becker's data (Ref 2). From the density and lattice
parameters the number of atoms of iron and silicon per
unit cell have been calculated (see Table). It was
found that in the whole α-leboite range there are almost
exactly 2 atoms of silicon (1.99) per unit cell and the
number of atoms of iron decreases steadily from 0.87
(53.5% Si) to 0.77 (56.5% Si) which points to the
formation of holes in the iron sublattice. A comparison
between X-ray and experimental densities confirms the
above conclusion. X-ray determination of thermal
expansion coefficients along the axes of the α-leboite
lattice has shown that the expansion coefficients increase
on transition to low-iron leboite; the expansion
coefficient increases particularly in the (001) planes
along iron atoms which corresponds to the hole model
structure of the $\int_α$-phase. There are 1 table and
2 English references.

Card 2/3   n.b. This is a complete translation, except Table.

18.8100, 24.7600

66242

SOV/126-8-3-30/33

AUTHORS: Gol'dberg, A.I., Lipatova, V.A. and Gel'd, P.V.

TITLE: The Electrical Conductivity and the Hall Effect in Alloys
             of Iron and Silicon, Containing Leboite, at High Temperatures

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8,
             Nr 3, pp 472-475 (USSR)

ABSTRACT: In an earlier paper (Ref 1) the authors reported their
             results of investigation of the electrical properties of
             β-leboite at room temperature; it was concluded that, in
             contrast to the ζ_α-phase, the ζ_β-phase is a semiconductor.
             To check this conclusion, the authors studied the
             temperature dependence of the electrical conductivity and
             the Hall effect of alloys of iron and silicon containing
             from 40 to 80% Si (by weight) at temperatures from 20 to
             350°C. The alloys were prepared in an induction furnace
             using silicon of Kr.O grade and Armco iron. Samples were
             prepared by sucking in the melt into quartz capillaries of
             2.5 to 4.0 mm diameter. The low-temperature modification
             of leboite was obtained by annealing at 800°C (Ref 2,3).
             All measurements were carried out employing the usual
             compensation apparatus and pressure contacts. It was
Card 1/5   found that alloys with more than 45% Si exhibit the typical

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The Electrical Conductivity and the Hall Effect in Alloys of Iron
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semiconductor type of variation of the electrical
resistance with temperature. The exponential dependence
of the resistance on temperature is particularly clear in
samples containing 49 to 51% Si. These samples are
closest in their composition to the $\int_\beta$-phase. Moreover,
their compositions are the same as those at which maxima
of the electrical resistance, the Hall constant and the
differential thermo-electric power occur on the curves
representing composition against property;   such maxima
are found both at room and at higher temperatures.
Outside the leboite region, all samples also exhibit
semiconducting properties but the latter are less
pronounced. In alloys containing 40 to 45% Si metallic
conductivity predominates. Fig 1 shows the experimental
data obtained for some of the samples plotted in
coordinates of log σ (σ is the conductivity) against T^{-1}
(T is the absolute temperature). Fig 1 shows that the
conductivity of samples containing 50 to 55% Si is
considerably greater than that of all the other samples

Card 2/5   and that alloys with 49 to 51% Si have the lowest

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conductivity. From the straight lines of Fig 1, the following impurity-centre activation energies (in eV) were obtained (the values in brackets denote % Si by weight): 0.13 (48%), 0.20 (49,51), 0.18 (53), 0.17 (55), 0.13 (57), 0.12 (59), 0.08 (65), 0.04 (75,80). The latter values show that there is a maximum in the dependence of the activation energy on the amount of silicon at compositions close to that of β-leboite. The temperature dependence of the Hall constant was measured only for some of the samples since, in the case of others, no reliable values could be obtained because of high scatter. Magnetic fields of 10^4 Oe were applied during these measurements and two directions of the field and current were used. The results obtained are given in Fig 2 which shows that the absolute value of the Hall constant of all samples decreases with increase of temperature. This indicates that the impurity carrier density rises with increase of temperature. Samples with 49 to 51% Si have positive Hall constants, ie their conductivity is of the hole type. This conclusion agrees

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with earlier measurements of the thermoelectric power
(Ref 1). Outside the leboite region, the Hall constant is
negative and its sign is reversed at 53 to 54% Si. In the
same region of concentrations a reversal of the sign of
the differential thermoelectric power was observed
earlier; it is due to the presence of silicon
crystallites in the alloys. The measurements carried out
can be used to estimate the values of the current-carrier
density and mobility. For example, the carrier density
in the alloys of leboite composition at room temperature
was found to be 7×10^{18} cm^{-3}, assuming that the Hall
constant R_x is given by $R_x = 1/ne$. The current-carrier
mobility for the same alloys amounted to 0.7 cm^{2}sec^{-1}v^{-1}.
The authors conclude that the results reported above
confirm the earlier suggestion (Ref 1) of semiconducting
properties of the low-temperature modification of leboite.
There are 2 figures and 3 Soviet references.

Card 4/5   n.b. This is a complete translation except for figures.

5.4700,18.8100

77132
SOV/148-59-9-2/22

AUTHORS: Gertman, Yu. M. (Engineer), Gel'd, P. V. (Doctor of Technical Sciences, Professor)

TITLE: Concerning the Thermochemistry of Manganese-Silicon

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1959, Nr 9, pp 15-27 (USSR)

ABSTRACT: An investigation of the change of enthalpy during the formation of some solid silicides and also of the heats of mixing liquid manganese and silicon. Some data regarding the specific heats and heats of melting silicides of manganese were published before. The dependence of the activity of silicon and manganese on the composition of melts Mn-Si-C, Mn-Si, and Mn-Fe-Si-C was studied previously by O. A. Yesin, N. A. Vatolin, V. A. Kozheurov, N. I. Sablin and B. P. Burylev. The electrolytic manganese (about 0.01% C; about 0.01% P; 0.05% S) of Zestafoni Ferroalloy Plant (Zestafonskiy ferrosplavnoy zavod) and crystalline silicon (98.5% Si; 0.8% Fe; 0.5% Al; 0.2% Ca) of Chelyabinsk Ferroalloy Plant (Chelyabinskiy ferrosplavnoy zavod) were used for the experiments. The flakes of electrolytic manganese

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Manganese-Silicon   SOV/148-59-9-2/22

were subject to the preliminary melting in corundum
crucibles in the argon atmosphere. The same crucibles
were used for the preparation of synthetic alloys
Mn-Si of different compositions. The heats of forma-
tion of solid solutions (at 20° C) were determined by
the method of burning, that is, by the difference of
heats of burnt alloy and of burnt mixture of pure
components of the same composition. The determination
of the heat of formation of solid silicides of mangan-
ese (Fig 2), of the heat of mixing liquid manganese
and silicon (Fig 4 and Fig 6), and also of the heat of
dissolving silicon in the liquid ferromanganese and in
ferrosilicomanganese (Figure 7) are discussed. During
the study of the heat of formation of solid manganese
silicides, it was found that for the monosilicide
$\Delta H = -$ 17.0 kcal/mole. The study of the heat of
mixing of liquid manganese and silicon showed that the
"first heat" of mixing is close to 25 kcal/mole. The
integral heat of mixing changes in accordance with the
composition, reaching a maximum (-9.3 kcal/g atom) for
equiatomic alloy. The authors advanced an idea

Card 2/7
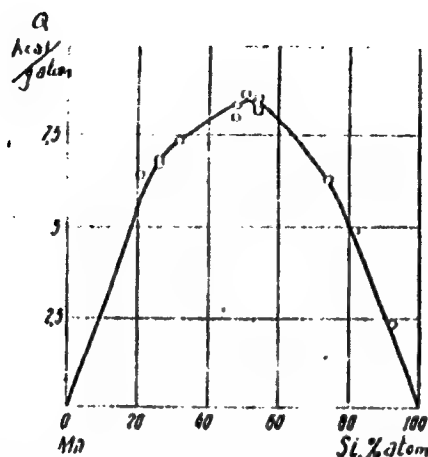
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Fig. 2. The heat of
formation of solid
alloys of manganese
and silicon at 20° C.

regarding the microheterogeneity of the melt and the
presence in it of "sibotaxis," enriched by the twin
complexes MnSi. (Abstracter's Note: The word
"sibotaxis" is unknown in American or Russian scienti-
fic literature. The following may be probable com-
ponents of this synthetic work, as obtained from the
Webster's Dictionary: Taxis (Greek) -arrangement,
order; cibation-a process of feeding with fresh
material during the course of operation. Therefore

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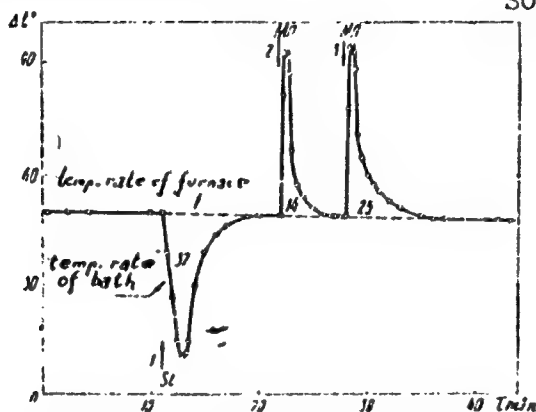
Fig. 4. The change of temperature of liquid silicon
with consecutive addition to it of one portion of
silicon and two portions of manganese.

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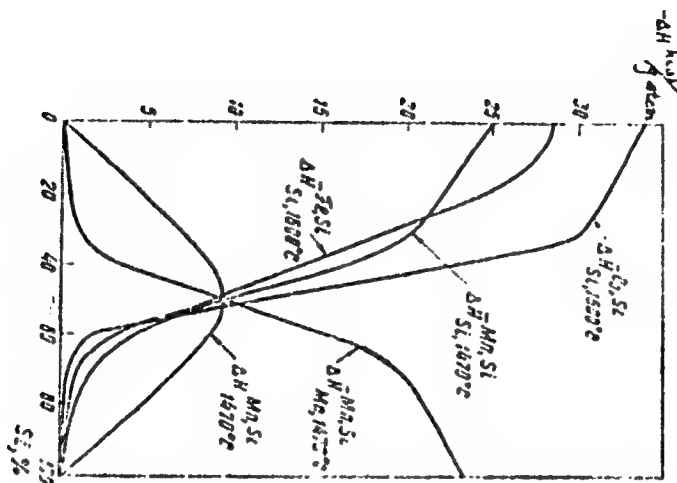
Fig. 6. A comparison of concentration relationship of partially molar heat content of silicon in its alloys with iron (1,600° C), cobalt (1,600° C), and manganese (1,470° C).

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Concerning the Thermochemistry of
Manganese-Silicon
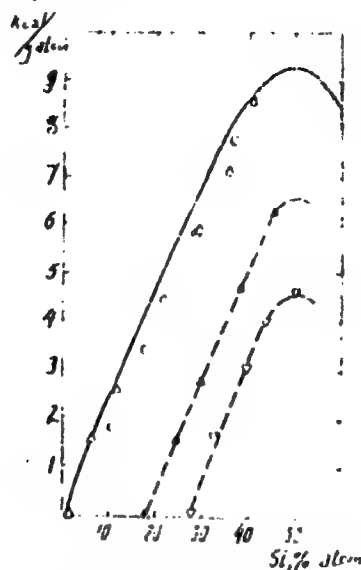
Fig. 7. The heats of mixing liquid silicon with
commercial manganese, ferromanganese, and silicomangan-
ese. Solid line—a characteristic of the pure Mn-Si
system.

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Concerning the Thermochemistry of
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"sibotaxis" probably is the author's version of an
idea of microheterogeneity of the melt and of a con-
tinuous feeding of same with fresh material enriched
by the twin complexes MnSi). In this connection it is
noted that there is a rather limited applicability
of the theory of regular solutions to the properties
of the studied systems. It was shown that the "first
heats" of dissolving the silicon in commercial mangan-
ese, ferromanganese, and manganese-silicon (taking
into account the silicon which is present in them)
differ very little from those established for the
synthetic alloys Mn-Si, amounting to 25-26 kcal/mole.
There are 7 figures; 4 tables; and 20 references; 13
Soviet, 4 German, 1 Belgian, 2 U.S. The U.S. refer-
ences are: Chipman, J., Grant, N., Trans. Amer. Soc.
Metals, 31, 365, 1943; Naylor, B. F., J. Chem. Phys.,
13, 329, 1945.

ASSOCIATION: Ural Polytechnic Institut (Ural'skiy politekhnicheskiy
               institut)
SUBMITTED: April 20, 1959   Card 7/7

SUCHIL'NIKOV, S.I.; GEL'D, P.V., doktor tekhn.nauk

Certain peculiarities in the roasting of molybdenum concentrates.
Trudy Ural.politekh.inst.   no.75:219-232 '59.
(MIRA 13:4)

(Molybdenum--Metallurgy)

KUSENKO, F.G.; GEL'D, P.V.

Heat capacity and changes of the isotherm-isobar potential during the formation of niobium dioxide. Trudy Ural. politekh. inst. no.92:121-124 '59.   (MIRA 13:12)
         (Niobium oxide--Thermal properties)

ALYAMOVSKIY, S.I.; GEL'D, P.V.; SHVEYKIN, G.P.

Niobium carbides. Trudy Ural. politekh. inst. no.92:125-134 '59.
(MIRA 13:12)
(Niobium carbide)

KOCHEROV, P.V.; GEL'D, P.V.

Elasticity of calcium vapors above fused calcium - aluminum systems.
Trudy Ural. politekh. inst. no.92:141-146 '59.   (MIRA 13:12)
        (Aluminum alloys)   (Vapor pressure)

18.7540

29036
S/081/61/000/018/007/027
B104/B101

AUTHORS: Gel'd, P. V., Kocherov, P. V.

TITLE: Regulation of liquid calcium - aluminum alloys

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 18, 1961, 51, abstract
              18B363 (Sb. "Stroyeniye i svoystva zhidk. metallov". M.,
              1960, 194 - 199)

TEXT: The enthalpy of two Ca-Al alloys containing 42.5% and 24.3% by
weight of Ca was investigated as a function of temperature in the range of
∿ 200 - 1200°C. According to its composition, the first of these alloys
is similar to the congruently melting compound $CaAl_2$ (melting point 1079°);
the second is similar to the incongruently melting compound $CaAl_4$ (melting
point 700°C). Results of measurements were compared with quantities
calculated according to the additivity rule. To explain the divergences
obtained it is assumed that during the melting process of the intermetallic
compounds and during superheating a considerable change of the potential
energy of the atoms occurs. This is caused by a change of the degree of

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S/081/61/000/018/007/027
B104/B101

Regulation of liquid...

order of fusion and by a change of the distance between particles and their interaction. [Abstracter's note: Complete translation.]

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18.9200

77707
SOV/148-60-1-30/34

AUTHORS: Sidorenko, F. A., Gel'd, P. V.

TITLE: Concerning the Structure of High-Temperature Leboite

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 1, pp 171-174 (USSR)

ABSTRACT: The electric properties of leboite, i.e., semiconducting $\zeta\alpha$-phase in Fe-Si system, are very sensitive to changes in the composition and alter abruptly at the transformation from high- to low-temperature modifications. According to G. Phragmen and other investigators, leboite of about $FeSi_2$ composition is tetragonal; its space group is $D_{4h}^1 = P4/mmm$; 1 molecular weight per unit cell; some Fe positions are occupied by Si atoms. The authors produced technically pure and highly pure leboite specimens of $FeSi_2$ composition (51.1 to 53% Si) by melting 99.95% pure silicon with iron carbonyl in quartz crucible placed in tungsten furnace in 0.001 to

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Concerning the Structure of High-Temperature   77707
Leboite   SOV/148-60-1-30/34

       0.0001 mm vacuum, powdered the specimens, homogenized
in vacuum at $1,050^{\circ}$ C for 75 hrs, hardened in air and
took powder diffraction photographs with camera VRS-3
and Co radiation, or with camera URS-50I and Fe radia-
tion. Some specimens were powdered again and annealed
at $1,050^{\circ}$ C before taking the diffraction photographs.
No difference in the diffraction intensity of different
specimens was evident at visual inspection if photo-
graphs had been taken with VRS-3 and Co radiation. On
the other hand, the intensity differences of different
diffraction lines could be measured having taken the
diffraction photographs from powder layers in slides
with camera URS-50I and Fe radiation. The unit cell
dimensions were found to be a = 2.69 kX and c = 5.13 kX;
the Si-to-Si interatomic distance = 2.26 kX and Si-to-Fe =
= 2.38 kX. There are 2 figures; 2 tables; and 6 refer-
ences, 5 Soviet, 1 U.K. The U.K. reference is G.
Phragmen, J. Iron and Steel Inst., 114, 397-403, 1926.
ASSOCIATION: Ural Polytechnic Institute (Ural'skiy politekhnicheskiy
           institut)
SUBMITTED: November 17, 1958   Card 2/2

KOCHEROV, P.V.; GEL'D, P.V.

Equilibrium of gaseous calcium with Ca-Al alloys. Izv. vys.
ucheb. zav.; chern. met. no.2:5-9 '60.   (MIRA 15:5)

1. Ural'skiy politekhnicheskiy institut.
                (Vapor-liquid equilibrium)
                  (Intermetallic compounds)

69656

5.2200(T)
5.4700

S/180/60/000/02/012/028
E111/E135

AUTHORS: Gel'd, P.V., and Kusenko, F.G. (Sverdlovsk)

TITLE: Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

ABSTRACT: The authors outline the present partly unsatisfactory position on the specific heats and heats of formation of substances involved in the increasingly important carbothermic process for the reduction of niobium oxides. Table 1 compares heat-of-formation values given by various workers (Refs 12-16), showing considerable differences. They go on to describe their own investigation of the heat contents of niobium oxides and carbides at 273 to 1840 °K. The niobium pentoxide used for preparation was purified by fractional precipitation and vacuum heating. Lower oxides were prepared by vacuum heating of briquettes made of this with niobium, finally at 1800 °C. Chemical compositions were determined as described by Gurevich and Ormont (Ref 19) for V – C – O; phase compositions by X-ray diffraction with a type RKD

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S/180/60/000/02/012/028
E111/E135

Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

camera. For temperatures up to 1500 °K the classical method of mixtures was used, the apparatus and differential method being as described by Serebrennikov and Gel'd (Ref 21), with 12-g samples, carefully degassed, sealed in a Pt - 10% Rh capsule. Experimental errors are estimated as not exceeding 0.8-1.0%. For determinations at 1500-1840 °K a vacuum high-temperature calorimeter was used, the thermal equivalents of both calorimeters being determined electrically against the reliably known (Refs 22, 23) thermal capacity of corundum. Heat capacities of capsules were found in a special series of experiments. As previously (Ref 21) experiments at 0-25 °C were carried out to convert ΔH values to 298.16 °K. The heat contents for Nb_2O_5 are shown in Table 3. The authors represent their data which relate to the high-temperature modification, by

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$$\Delta H^T_{298.16} = 38.76\ T + 1.77 \cdot 10^{-3}T^2 + 7.318 \cdot 10^5 T^{-1} - 14162 \qquad (Eq\ 1)$$

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Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

and compare (Fig 2) their results with those of Orr (Ref 18). The same Table gives the data for NbO_2; they are represented in Fig 3. The relation is

$$\Delta H^T_{298.16} = 14.681\,T + 3.079 \cdot 10^{-3}T^2 + 2.421 \cdot 10^5 T^{-1} - 5460 \qquad (Eq\ 4)$$

while above 1080 °K it is

$$\Delta H^T_{298.16} = -8060 + 21.28T \qquad (Eq\ 6)$$

The results for NbO and Nb are shown in Table 4 and Fig 4. The relations are represented by, respectively,

$$\Delta H^T_{298.16} = 10.04T + 1.175 \cdot 10^{-3}T^2 + 0.783 \cdot 10^5 T^{-1} - 3359 \qquad (Eq\ 8)$$

and

$$\Delta H^T_{298.16} = 5.60T + 0.655 \cdot 10^{-3}T^2 - 1727 \qquad (10)$$

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The latter relates to a sample with 0.5% by weight of dissolved and combined oxygen. For carbides the results

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Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

are shown in Tables 5 and 6 and Fig 5. The relationships are:

$$Nb\ C_{0.50}: \Delta H_{298.16}^{T} = 7.94T + 0.750 \cdot 10^{-3}T^2 +$$
$$+ 1.025 \cdot 10^5 T^{-1} - 2776 \tag{14}$$

$$Nb\ C_{0.749}: \Delta H_{298.16} = 8.95T + 1.127 \cdot 10^{-3}T^2 +$$
$$+ 1.26 \cdot 10^5 T^{-1} - 3190 \tag{16}$$

$$Nb\ C_{0.867}: \Delta H_{298.16} = 9.70T + 0.995 \cdot 10^{-3}T^2 +$$
$$+ 1.51 \cdot 10^5 T^{-1} - 3485 \tag{18}$$

$$Nb\ C_{1.00}: \Delta H_{298.16}^{T} = 10.79T + 0.863 \cdot 10^{-3}T^2 +$$
$$+ 2.15 \cdot 10^5 T^{-1} - 4013 \tag{20}$$

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The authors point out that their data together with available data can be used for thermodynamic calculations on equilibria in the systems Nb – C – O and Nb – H – O and related ones.

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E111/E135

Heat Content and Specific Heat of Niobium Oxides and Carbides at
High Temperatures

There are 5 figures, 6 tables and 24 references, of
which 12 are Soviet, 10 English and 2 German.

Card 5/5

SUBMITTED: November 30, 1959

IGISHEV, V.N.; GEL'D, P.V.

Electric conductivity of solid silicon solutions in iron at high temperatures. Izv. vys. ucheb. zav.; chern. met. no.2: 90-94 '60.   (MIRA 15:5)

1. Ural'skiy politekhnicheskiy institut.
    (Iron-silicon alloys—Electric properties)
         (Metals at high temperatures)

GEL'D, P.V.

82440

S/149/60/000/004/003/009

5.2200

AUTHORS: Kusenko, F.G., Gel'd, P.V.

TITLE: On Some Properties of NbO_2

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 1960, No. 4, pp. 102-106

TEXT: In a paper published recently on the heat capacity of NbO_2 within a temperature range of 298-1,500°K, the authors assumed that there was a phase transformation near 750°C. To check this assumption and to study the properties of NbO_2 near the temperature of the supposed transformation, the authors investigated the heat content, electric conductivity and thermal expansion of synthetic NbO_2 within 298-1,500°K. The NbO_2 compound was prepared from a briquetted mixture of purified niobium pentoxide and niobium metal powder, by annealing at 1,500°C in a tungsten vacuum furnace. The temperature dependence of the NbO_2 heat content was investigated by the differential mixing method. To protect the preparation from oxidation, it was placed in a platinum-rhodium alloy ampoule. The heat content of the empty ampoule and of one containing the sample was investigated in an adiabatic calorimeter. The temperature was measured by a potentiometer. Results of the experiments are shown in Graph 1. The temperature dependence of NbO_2 heat

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On Some Properties of NbO2   S/149/60/000/004/003/009

content up to 1,010°K can be expressed by the Mayer-Kelly formula (1): $\Delta H_{298}^{T} =$ $= -5460 + 14.681\ T + 3.078 \cdot 10^{-3}T^2 - 2.421 \cdot 10^5 T^{-1}$. The temperature dependence of the NbO2 heat capacity is described by formula (2): $C_p = 14.681 + 6.156 \cdot$ $\cdot 10^{-3}T - 2.421 \cdot 10^5 T^{-2}$. Above 1,080°K the heat content increases linearly with temperature up to 1,500°K. In the range of 1,010-1,080°K the heat content in- creases at an anomalously high rate, resembling temperature dependences of substances undergoing phase transformations of second order. The heat capacity increases rapidly but monotonously with raising temperature up to 1,010°K. It is constant over 1,080°K. Between 1,010 and 1.080°K a typical λ-point is observed. The data obtained indicate the possible phase transformation of NbO2 near 750°C. To verify this, the temperature dependence of electric conductivity and thermal expansion of NbO2 were studied. It was established that NbO2 was a semiconductor whose energy gap changed from 0.66 ev at 298° - 715°K to 1.41 ev at 950°-1.050°K. The trans- formation of NbO2 appears on a graph (3) where the curve $\sigma = \varphi$ (T) suffers an abrupt bend at 1.050°K. Dilatograms of two NbO2 samples (Fig. 4) reveal clearly the changes in the temperature curves of expansion near 1.050°K. Consequently, the conclusion is drawn that NbO2 undergoes a phase transformation near 1.040°K. There are 4 graphs and 9 references: 7 Soviet and 2 English.
ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)
SUBMITTED: September 18, 1959

Card 2/2

85736
S/148/60/000/004/003/006
A161/A029

24.7100   1035,1559, 1143

AUTHORS: Gol'dberg, A.I., Lipatova, V.A., Gel'd. P.V.

TITLE. Electrical Properties of the FeSi-Si Alloy System

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallurgiya, 1960, No. 4, pp. 121-127

TEXT: The low-temperature modification of the β-phase of the Fe-Si system has semiconductor properties, which has been proven before (Ref. 1,2), but the material investigated was of commercial purity. To get more accurate data an investigation has been carried out of alloys made of electrolytic iron and splinters of single crystal p-silicon molten in quartz crucibles in a high-frequency induction furnace. The alloys contained Al, Mg, Mn, Pb, Ni and Cr in a quantity not above 0.001 %. The conductivity, the Hall constant and thermoelectric motive force was measured in the temperature range from 20 to 400°C. A potentiometric device described in (Ref. 3) was used that makes simultaneous measurements of all these three characteristics possible. The data obtained are illustrated by graphs. Pronounced semiconductor properties of the $\zeta\beta$ - phase and electronic conductivity were proven. Alloys with 38 to 100 % Si had a low conductivity (Fig. 2) with positive temperature coefficient indicating

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A161/A029

Electrical Properties of the FeSi-Si Alloy System

semiconductor properties. Judging by polytherms (Fig. 2), alloys with high content of β-leboite were up to 350-400°C conductive through alloying consti- tuents, and then eigenconductive in a relatively narrow temperature range. Alloys with higher Si content had a comparatively long characteristical transi- tion range between 200°C and excitation of eigenconductivity at about 400°C. This agrees well with literature data (Ref. 4) on the properties of Si of dif- ferent purity. In general, the characteristics of commercial alloys and pure alloys studied here are considerably different. First of all, the current carriers in β-leboite have different sign: commercial alloys have hole con- ductivity, and purer alloys electronic conductivity. This is directly con- nected with the Al content (about 0.2 % in commercial leboite), whose effect is known since long (Ref. 9). It is expected that p-n transfers may be ob- tained in β-leboite, e.g., by alloying it with aluminum, and that pure leboite can be utilized in couple with alloyed aluminum in thermocouples with high temf for temperature measurements in high ranges up to 800-900°C in corrosive environment. Further investigations of the FeSi-Si system are necessary, mainly to determine the effect of different constituent elements and for the content
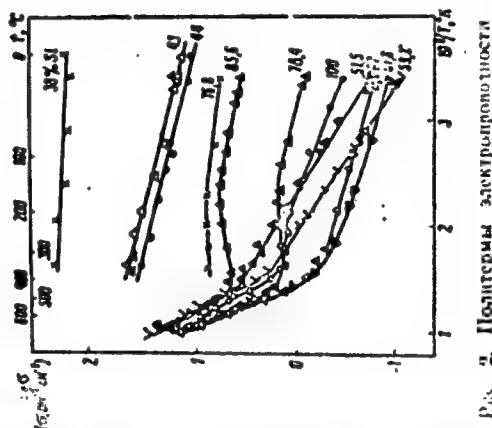
Card 2/3

85736
S/148/60/000/004/003/006
A161/A029

Electrical Properties of the FeSi-Si Alloy System

of the semiconductive β-phase of leboite. There are 8 graphs and 9 references:
7 Soviet, 2 English.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical Institute)

SUBMITTED: July 14, 1959

Figure 2:
Polytherms of Electric Conductivity

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88042
S/139/60/000/006/004/032
E032/E314

9.4300 (and 1143, 1155)

AUTHORS: Korshunov, V.A. and Gel'd, P.V.

TITLE: The Electrical Resistivity and Thermoelectric Power of Magnanese-silicon Alloys. I. Technical Alloys Containing Mn_3Si and Mn_5Si_3

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 6, pp. 29 - 34

TEXT: Preliminary results of the work now reported were published in Ref. 4. It was shown there that some of these alloys have semiconducting properties. This conclusion was confirmed by Guseva and Ovechkin (Ref. 5) and Dorfman (Ref. 6) in the case of $CrSi_2$ and $MnSi_2$. The present paper reports data on the temperature dependence of the resistivity σ in the temperature interval 20 - 1 350 ^{o}C and the thermoelectric power α in the temperature interval 20 - 700 ^{o}C for alloys of technical Si and electrolytic Mn containing between 14 and 22% Si by weight. The alloys were prepared from electrolytic Mn (99.88% Mn; C, P, Al, Si, Ti approximately 0.01% each)

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S/139/60/000/006/004/032
E032/E314

The Electrical Resistivity and Thermoelectric Power of
Manganese-silicon Alloys. I. Technical Alloys Containing
Mn_3Si and Mn_5Si_3

and crystalline silicon of type KpO (KrO) (98.5% Si,
$\sim$ 0.5% Fe, $\sim$ 0.2% Ca and $\sim$ 0.2% Al). Weighed portions
of these materials were placed in quartz containers and outgassed
at 700 - 800 ^{o}C. The quartz containers were then sealed-off
and the alloys were produced by heating in an induction furnace.
The resistivity was measured both in solid and liquid states,
using the method described by Regel' in Ref. 11. The res-
istivity was measured to an accuracy of 4-5%. In the case of
the thermoelectric power measurements, temperature differences
of the order of 10 ^{o}C were produced by special nichrome
heaters. Thermal expansion corrections for σ were introduced
in accordance with the method described by the present
authors in Ref. 12. It was found that the temperature
coefficient of resistivity changes from "metallic" to "semi-
conducting" at a temperature of about 500 ^{o}C. The

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semiconducting character of the curve representing the
resistivity as a function of temperature is preserved on
transition to the liquid state. Thermal e.m.f. studies
showed that hole-type conductivity obtains. It is suggested
that the current-carrier gas at room temperature is
degenerate. There are 3 figures and 20 Soviet references.

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni
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SUBMITTED: January 14, 1960

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18.1200   1454,1449   S/180/60/000/006/024/030
                          E111/E335   86704

AUTHORS: Gel'd, P.V., Korshunov, V.A. and Petrushevskiy, M.S.
             (Sverdlovsk)

TITLE: Some Peculiarities of Liquid Alloys of Silicon With
             Iron, Manganese and Chromium

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye
             tekhnicheskikh nauk, Metallurgiya i toplivo,
             1960, No. 6, pp. 129 - 134

TEXT: The authors point out that the thermodynamic properties
of liquid alloys of silicon with transition elements of the
fourth period deviate substantially from the laws of both ideal
and regular solutions (Refs. 1, 2). They class such silicide
solutions as solutions with strongly interacting particles,
whose theory has not yet been fully developed. Of the various
models proposed to represent the structural characteristics
corresponding to these features, the authors favour those
envisaging a micro-heterogeneous structure with closest order.
They cite evidence against the alternative model with uniform
(statistical) particle distribution and survey critically

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Some Peculiarities of Liquid Alloys of Silicon With Iron,
Manganese and Chromium

coefficient in Fe-Si-C than in Mn-Si-C (Ref. 18) (Fig. 3) is
understandable in that iron atoms are more weakly combined with
carbon particles (and more strongly with silicon) than manganese
atoms. Because of the lower bonding energy of chromium with
silicon and higher with carbon, the solubility of carbon in
Fe-Cr-Si-C is higher (Fig. 4) than in the other systems
considered; the influence of iron on chromium is also more
pronounced. The differences in separation of carborundum crystals
from the different melts is due to such effects. Of the authors,
Gel'd has made many contributions in this field.
There are 4 figures and 18 references: 15 Soviet and
3 non-Soviet.

SUBMITTED: August 26, 1960

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S/180/60/000/006/025/030
E111/E335

18.1200   1454, 1449

AUTHORS: Gel'd, P.V. and Gertman, Yu.M. (Sverdlovsk)

TITLE: Interparticle Interaction in Liquid Alloys of
Silicon with Iron and Nickel

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye
tekhnicheskikh nauk, Metallurgiya i toplivo,
1960, No. 6, pp. 134 - 137

TEXT: Numerous studies of liquid alloys of silicon with
transition metals of the fourth period have indicated that
alloying is accompanied by a great increase in particle
interaction. Gel'd et al (Refs. 1, 2) have proposed the
formation of quasimolecules with directed bonds which produce
the cybotactic microheterogeneous structure. This has been
confirmed (Ref. 3). To obtain further information the authors
determined density isotherms at 1500 $^{\circ}$C for alloys of silicon

with iron and nickel. Density, d, g/cm^3, as a function of
vol. % iron (0-100) is shown in Fig. 1; density values are
above additive throughout. On fusion silicon density rises

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Interparticle Interaction in Liquid Alloys of Silicon with
Iron and Nickel

by about 9%, about double the reported rise for germanium
(Refs. 6, 7) and fusion is probably associated with an increase
in coordination number, delocalisation of valency electrons
(Refs. 7, 9) and a large decrease in resistivity (Ref. 7).
Density changes suggest that in silicon-high liquid alloys there
are stable groupings structurally related to alpha-lebeauite
and the ε-phase. Nickel silicon alloys provide a further
illustration of the role of coordination. Here, the greatest
deviation of density from the additivity relation occurs at
compositions corresponding to the congruently melting Ni_2Si

(Fig. 2). The comparatively small decrease in volume on forming
the Ni-Si melt is understandable in terms of coordination effects

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